
एक्स्पेंडेड विनाइल
कोटेड फेब्रिक की विशिष्टि
(दूसरा पुनरीक्षण)

**Specification for Expanded Vinyl
Coated Fabrics**
(*Second Revision*)

ICS 83.060

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Rubber and Rubber Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

The standard was originally published in 1977 and subsequently revised in 1984. This standard covered two types of material, namely, Type A and Type B depending on the base fabric used. Further, the two types shall have grades depending on the thickness of the coated material.

During the first revision, the Committee was of the opinion that resistance to flame was an important requirement and the entire material being made in the country should also pass this test. However, considering the stage of the industry in the country and also the fact that this material was used in many non-critical uses, it was agreed to prescribe two classes of material, namely, class A and class B in the standard. Class B material is not recommended for applications where flame resistance is important from the safety point of view.

In this second revision, the standard is being upgraded based on the current trade practices and quality requirements. In this revision, procedure for testing of flame resistance has been modified based on developments over a period of time. Taking into cognizance of the fire hazard in the use of vinyl coated fabrics, three classes of material have been prescribed, namely, class A, class B and class C. The recommended usage of various classes of expanded vinyl coated fabrics have also been prescribed.

In view of availability of fabric of higher strength, used as backing cloth, requirement of breaking strength have been revised. Further, the following changes have been made:

- a) Time factor between manufacture and testing has been specified;
- b) Requirement of tear strength has been incorporated to ensure products with better tearing properties;
- c) Requirement of block resistance has been incorporated to determine resistance to blocking at elevated temperature;
- d) Requirement of water proofness has been added to check water penetration, through coated fabric used in upholstery, which may cause dampness, in underneath cushioning material;
- e) The scheme of selection of test specimens has been revised; and
- f) Amendment No. 1 has also been considered while revision of the standard.

Expanded vinyl coated fabrics commonly known as foam leather cloth and manufactured by applying on one side of a woven or knitted fabric, a substantially continuous coating of suitably compounded polymer of vinyl chloride or a copolymer, the major constituent of which is vinyl chloride. During processing, part of PVC coating is expanded. Such coatings are known as poly (vinyl chloride) (PVC) coatings.

Vinyl coated fabric is now being increasingly used, for a variety of purposes. It is established that the major cause of fatalities during fire are directly attributed to the accidental ignition of upholstery which makes the flammability testing an important requirement of expanded vinyl coated fabrics.

When subjected to constant tensile load for a given time, vinyl coated knitted fabric stretches. When the load is removed, the coated fabric tends to recover its initial length. In practice, the visco-elastic characteristics of plasticized PVC result in a permanent residual elongation, the magnitude of which depends upon many factors, such as the size of the applied load, the duration of loading, the width over which the load is applied, the elasticity of coated fabric, the temperature and humidity during the test, and the time allowed for recovery after removal of the load. Coated fabric, under constant stress in use, therefore, should have good elasticity and a small permanent elongation in use. These characteristics of elongation and elastic recovery have also been introduced.

The composition of the Committee responsible for the formulation of this standard is given in Annex M.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified values in the standard.

Indian Standard

SPECIFICATION FOR EXPANDED VINYL COATED FABRICS

(Second Revision)

1 SCOPE

This standard prescribes requirements, methods of sampling and test for expanded vinyl coated fabrics whether plain, embossed, printed or otherwise surface treated, made from knitted or woven fabrics, obtained by applying to one side of base fabric, a substantially continuous coating of a suitably plasticized polymer of vinyl chloride, or a copolymer the major constituent of which is vinyl chloride.

2 REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

| IS No. | Title |
|--|---|
| IS/ISO 105-B02 : 2014 | Textiles — Tests for colour fastness: Part B02 Colour fastness to artificial light : Xenon Arc fading lamp test |
| 177 : 1989 | Cotton drills — Specification (<i>fourth revision</i>) |
| 285 : 2021 | Laundry soaps — Specification (<i>fourth revision</i>) |
| 296 : 1986 | Specification for sodium carbonate, anhydrous (<i>third revision</i>) |
| 2244 : 1972 | Glossary of terms relating to treated fabrics (<i>first revision</i>) |
| 4905 : 2015 | Random sampling and randomization procedure (<i>first revision</i>) |
| 7016 (Part 1/Sec 1) : 2016/ ISO 2286-1 : 1998 | Methods of test for coated and treated fabrics : Part 1 Determination of roll characteristics, Section 1 Methods for determination of length, width and net mass (<i>second revision</i>) |

| | |
|--|---|
| 7016 (Part 1/Sec 2) : 2019/ ISO 2286-2 : 2016 | Methods of test for coated and treated fabrics: Part 1 Determination of roll characteristics, Section 2 Methods for determination of total mass per unit area, mass per unit area of coating and mass per unit area of substrate (<i>second revision</i>) |
| 7016 (Part 2) : 2015/ ISO 1421 : 1998 | Methods of test for coated and treated fabrics: Part 2 Determination of tensile strength and elongation at break (<i>second revision</i>) |
| 7016 (Part 3/Sec 1) : 2017/ ISO 4674-1 : 2003 | Methods of test for coated and treated fabrics: Part 3 Determination of tear resistance, Section 1 Constant rate of tear method (<i>second revision</i>) |
| 7016 (Part 4) : 2003/ ISO 7854 : 1995 | Methods of test for coated and treated fabrics: Part 4 Rubber-or plastics-coated fabrics — Determination of resistance to damage by flexing (<i>second revision</i>) |
| 7016 (Part 5) : 2019/ ISO 2411 : 2017 | Methods of test for coated and treated fabrics : Part 5 rubber-or plastics-coated fabrics — Determination of coating adhesion (<i>third revision</i>) |
| 7016 (Part 9) : 2003/ ISO 5978 : 1990 | Methods of test for coated and treated fabrics: Part 9 rubber or plastics-coated fabrics — Determination of blocking resistance (<i>second revision</i>) |
| 15061 : 2002 | Automotive vehicles — Flammability requirements |

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2244 and the following shall apply.

3.1 Printed Expanded Vinyl Coated Fabrics — Expanded vinyl coated fabrics with a continuous or discontinuous, transparent or coloured surface coating, which also includes, all multi-tone effects and lacquered surfaces.

4 CONDITIONING

4.1 Most coated fabrics contain a certain amount of moisture absorbed from the air with which they are in contact, and the amount of moisture depends on the quantity of water vapour in the air. Certain properties, particularly mass and those concerned with the breaking of threads, are affected by the moisture content of the fabric. On the other hand, properties like flexing, blocking and flammability are affected by ambience temperature. Therefore, in order to standardize, conditioning of test pieces are done in an atmosphere of controlled humidity and temperature before testing.

4.1.1 Standard Atmospheric Conditions for Testing

Unless otherwise specified, the test specimens shall be conditioned, in an atmosphere with relative humidity of 65 ± 5 percent and temperature of 27 ± 2 °C for 16 h.

5 TIME ELAPSED BETWEEN MANUFACTURE AND TESTING

5.1 In order to ensure that the material attains dimensional stability due to stress relaxation, for all test purposes, the minimum time between manufacture and testing shall be 16 h.

5.2 In order to bind the user and supplier, to stipulate time for carrying out conformity test for supplied material, the following shall apply:

5.2.1 For non-product test, separate test pieces are required for testing. The maximum time between the manufacture and testing shall be eight weeks and for evaluation intended to be comparable, the tests as far as possible, shall be carried out after the same time interval.

5.2.2 For product test, whenever possible, the time between manufacture and testing should not exceed six months. In other cases, tests shall be made within four months of the date of the receipt of the product by the customer.

6 TYPES, GRADES AND CLASSES

6.1 Types

There shall be two types of expanded vinyl coated fabrics, depending upon the type of base fabric used as indicated below:

- a) Type A — Made from woven fabric; and
- b) Type B — Made from knitted fabric.

6.2 Grades

Type A material shall be of three grades and Type B of two grades depending on the thickness as indicated

below. The thickness shall be determined as prescribed in Annex A.

| Type | Grade | Thickness (mm) |
|--------|---------|----------------|
| Type A | Grade 1 | 1.3 to 1.5 |
| | Grade 2 | 1.0 to 1.2 |
| | Grade 3 | 0.7 to 0.9 |
| Type B | Grade 1 | 1.0 to 1.2 |
| | Grade 2 | 0.7 to 0.9 |

6.3 Classes

Based on flame resistance characteristics, all grades of material shall be of three classes, class A, class B and class C. The recommended usage of various classes of expanded vinyl coated fabrics are given in **6.3.1**, **6.3.2** and **6.3.3** for guidance purpose only.

6.3.1 Class A material is recommended to be used in high hazard category of usage like upholstery for seats, berths and cushions in railways and automobiles, sleeping accommodations in hospitals, hotels, prisons, home and office furniture, offshore installations etc. The material shall be tested for flame resistance to meet the requirements as given in **7.12.1**.

6.3.2 Class B material is recommended for usage in curtains, blinds and/or other hanging materials. The material shall be tested for flame resistance to meet the requirements as given in **7.12.2**.

6.3.3 Class C material is to be used in low hazard category usage and shall be tested to flame resistance as given in **7.12.3**.

7 REQUIREMENTS

7.1 Description

The expanded vinyl coated fabrics shall consist of polyvinyl chloride polymer or vinyl copolymer which is either transfer coated or is spread on base fabric. The intervening layer shall be expanded.

7.2 Base Fabric

The base fabric shall be made from cotton, rayon or other synthetic fibre or their blends. In case of woven fabric, it shall be dyed/scoured. In case of black shades, sulphur dyes shall not be used.

7.3 Appearance

When a test piece 2 m long and having the width of the material is cut from the sample and placed on flat illuminated surface suitable for showing up defects, the material shall be of uniform surface finish, contain

no bubbles and blisters, substantially free from pinholes, creases or streaks and reasonably free from foreign matter.

NOTES

1 The attention of users is drawn to the fact that the coated fabric may be damaged if wrong methods of cleaning are used. Furniture creams, dry cleaning solvents, pastes or waxes should not be used. For cleaning, only a soft cloth dampened with soap and water or a mild detergent solution should be used. The surface should then be well rinsed with plain water and dried with a cloth.

2 It is possible that the surface is marked with the pattern of the back surface if the roll has been wound too tight. Such marks are reversible and acceptable. They can be easily identified by heating a piece of coated fabric for a few minutes in an oven at a temperature around 100 °C, the marking due to tight winding disappears.

7.4 Colour, Grain and Finish

The colour, grain and finish of the material whether in single colour or multi-colour effects, shall be as agreed between the purchaser and the supplier. This agreement can be based on a reference sample, and on illustrations or other ways of indicating acceptable deviations from the reference sample. Recommended procedures and the standard conditions for comparing colours are described in Annex B.

7.5 Coating

The compound used for coating shall be made from suitably compounded vinyl chloride polymer or copolymer. It shall be fully pigmented to meet specified colour requirements and shall be free from disagreeable odour. The coating shall be uniformly applied on one side of the base fabric.

NOTE — In case of sateen and twill/drill the coating shall be on the back side.

7.6 Resistance to Heat and Loss of Mass on Heating

The coating shall withstand an exposure of 24 h in hot air circulating oven at a temperature of 100 ± 2 °C without showing signs of exudation or stickiness, when tested as prescribed in Annex C. The loss of mass shall not be greater than 5 percent.

7.7 Resistance to Cold

The coating shall not crack when a sample specimen about 250 mm long and about 6 mm wide, is subjected to a bending test around a 6 mm diameter steel pin after exposure in cold. The steel pin and coated fabric shall be kept at 0 ± 2 °C for a required period of 1 h and the test carried out within 60 s of removal of the sample. Wherever, practicable, the test shall be carried out in a cooling chamber.

NOTE — The test shall be carried out with coated surface on the outside.

7.8 Colour Fastness to Dry and Wet Rubbing

When tested as prescribed in Annex D, the material shall be considered satisfactory, when stain on cotton

rubbing cloth is rated not less than No. 4 with the grey scale under suitable illumination.

NOTES

1 Metallic shades and printed leather cloth are not likely to withstand this test. However, when printed leather cloth is intended to be used for upholstery purposes, the number of abrading cycles shall be as agreed to between the supplier and the purchaser.

2 When testing black coloured coated fabric, caution is to be taken in cleaning the surface before testing and distinguishing between colour stains and dust stains.

7.9 Colour Fastness to Light

The test pieces shall be tested for colour fastness to daylight according to Annex E. Alternatively, a quicker method of determining colour fastness to light by xenon arc, as prescribed in IS/ISO 105-B02 may be carried out. For this test, exposure method 3 or 4 are recommended. The material shall be considered satisfactory, when colour fastness rating of any test piece, is not less than No. 4 of the standard pattern of plain dyed wool fabrics, as prescribed in IS/ISO 105-B02. Effect on printing may be observed in case of printed material.

7.10 Gelling Test

Cut a sample specimen 250 mm long and 50 mm wide from the coated fabric. The sample specimen shall show no signs of cracking when it is folded double preferably around an aluminum plate or stainless steel plate about 2 mm thick and immersed for 30 s in a glass beaker containing acetone.

NOTE — During immersion the coated face shall lie outwards. Care shall also be taken to ensure that the coated face does not touch the sides or bottom of the beaker.

7.11 Adhesion of Print (for Printed Expanded Vinyl Coated Fabrics)

When examined as prescribed in Annex F, the number of cycles to remove either the printed pattern or any area of printed material shall be greater than five.

7.11.1 In case of metallic and white printing inks, adhesion of print shall be subject to agreement between the purchaser and the supplier.

7.12 Flame Resistance

The fire resistance property shall be inherent quality of coating and no subsequent treatment should be done after the manufacture to achieve this property. The fabric of three classes shall be tested for flame resistance as under:

7.12.1 *Class A* — The fabric shall be tested for flame resistance and shall meet the requirements as given in 3.2 of IS 15061.

7.12.2 *Class B* — The fabric shall be tested for flame resistance and shall meet the requirements as given in 3.3 of IS 15061.

7.12.3 Class C — The fabric shall be tested for flame resistance as per Annex G and the duration of flaming of the specimen tested shall not exceed 20 s, after removal of the source of ignition.

7.13 Adhesion of Coating

When tested in accordance with IS 7016 (Part 5), the force required to separate the ply over a distance of 100 mm, should be not less than 2 Kgf (20 N) per 50 mm width.

NOTE — If the coating does not pull down to the backing or fabric, then the test machine should be stopped and the coating on the ply in the jaw shall be carefully cut to the fabric. Then the machine shall be restarted.

7.14 Blocking Resistance

When tested in accordance with IS 7016 (Part 9) at 70 ± 2 °C for 3 h, the specimen shall show no blocking that is coated surfaces shall separate without any signs of adhering.

7.15 Resistance to Penetration of Water (For Grade 1 and 2 of Type A and Type B) — When tested in accordance with Annex H, no drop of water shall appear in 30 min, on the underside of the test piece, up to 50 cm water column height.

7.16 Elongation and Elastic Recovery for a Constant Load (for Type B)

When subjected to constant tensile load for a given time, a coated fabric stretches. When the load is removed, the coated fabric tends to recover its initial length. Coated

fabric under constant stress in use, therefore, should have good elasticity and a small permanent elongation in use.

Expressing the permanent elongation as a percentage of the initial elongation gives suitable measure of elasticity of a coated fabric. This parameter known as elastic recovery is the portion of the initial elongation, which is recovered during relaxation period and is expressed as a percentage of the initial elongation.

The method used shall consist of the application of a 10 kg load to a test specimen 100 mm wide for 10 min followed by 10 min relaxation. When tested as prescribed in Annex J, the elongation and elastic recovery, shall meet the following requirements.

The elongation in warp direction, shall be more than 10 percent and in weft direction it shall be more than 20 percent.

The elastic recovery, as percentage of actual elongation, in both directions shall be more than 80 percent.

NOTE — In the case of materials of low extensibility, in order to obtain a sufficiently high degree of accuracy, it may be necessary to use longer test specimens and modify the method of calculation of the result. In all cases, the exact conditions of test should be stated.

It may be desired to know the load needed to produce a particular elongation or tension set. This may be determined by carrying out the test at a number of suitably selected loads and by interpolation of the results.

7.17 Expanded Vinyl Coated Fabrics shall also comply with the requirements as given in Table 1.

Table 1 Requirements for Expanded Vinyl Coated Fabrics

(Clauses 7.17, 7.17.1, 7.17.3, 7.17.4 and 8.1)

| SI No. | Characteristic | Requirements For | | | | | Method of Test, Ref To IS |
|--------|---|------------------|---------|---------|---------|---------|---------------------------------------|
| | | Type A | | | Type B | | |
| | | Grade 1 | Grade 2 | Grade 3 | Grade 1 | Grade 2 | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | Usable width, <i>Min</i> , cm | 127 | 127 | 127 | 127 | 127 | IS 7016 (Part 1/Sec 1) |
| ii) | Mass of finished fabric, <i>Min</i> , g/m ² | 800 | 700 | 600 | 600 | 500 | IS 7016 (Part 1/Sec 2) |
| iii) | Breaking/tensile strength in kgf, <i>Min</i> | | | | | | Method 1 of IS 7016 (Part 2) |
| | a) Longitudinal direction | 80.0 | 70.0 | 60.0 | 25.0 | 15.0 | |
| | b) Transverse direction | 65.0 | 50.0 | 40.0 | 15.0 | 10.0 | |
| iv) | Tear strength (load in Kg) in both directions, <i>Min</i> | 8.0 | 6.0 | 4.0 | 3.0 | 2.0 | Method A of IS 7016 (Part 3/Sec 1) |
| v) | Resistance to damage by flexing (number of flexing cycles in thousands), <i>Min</i> | | | | | | Method A of IS 7016 (Part 4) |
| | a) First stage | 200 | 200 | 200 | 200 | 200 | |
| | b) Second stage ¹⁾ | 300 | 300 | 400 | 400 | 400 | |

¹⁾ The number of flexing cycles of the second stage includes the number of flexing cycles of the first stage.

7.17.1 Width of the Finished Fabric

The usable width, when measured in accordance with IS 7016 (Part 1/Sec 1), shall be width of material that is coated in such a manner that it complies with the requirements as given in Table 1. Width other than those as specified in Table 1, may also be supplied, if agreed between the purchaser and the supplier.

7.17.2 Mass of Finished Fabric

Mass of finished fabric shall be tested in accordance with IS 7016 (Part 1/Sec 2). Three test pieces, one from the centre and the other two symmetrical with the first, in such a manner that their external edge is between 50 and 150 mm from the selvedge of the sample taken along a line which makes an angle of 45° with the length of the roll.

7.17.3 Breaking/Tensile Strength

When tested in accordance with Method 1 of IS 7016 (Part 2), the materials shall comply with the requirements as given in Table 1. Each test piece shall be 50 ± 0.5 mm wide and of sufficient length to allow a distance of 200 ± 1 mm between the jaws of the test machine. If the elongation exceeds 75 percent, reduce the length to 100 ± 1 mm.

7.17.3.1 If there is a woven support, take a wider strip and reduce the width to 50 ± 0.5 mm by fraying if possible. If fraying is not possible, cut the test pieces in the direction of testing as exactly as possible, along a thread. It is very important to ensure that the test pieces are parallel to the warp threads or weft threads, as the case may be.

7.17.3.2 If there is a knitted support, cut the test pieces to their final dimensions by following a wale or course. In case of knitted fabrics, the direction with higher strength value, shall be taken as warp direction and the other direction shall be perpendicular to it.

NOTE — If any test piece breaks within 10 mm of line of contact of either of the jaws, record the result; but if it is found to have broken at a load less than 75 percent of the average of the remainder of the specimens, do not use it in calculating the breaking load. Test another specimen.

7.17.4 Resistance to Damage by Flexing

When tested by Method A of IS 7016 (Part 4), the material shall comply with the number of flexing cycles given in Table 1. The material shall be considered to have complied with the requirements, if none of the test pieces, has shown signs of cracking to stage 'D', after the First stage and not more than half the test pieces have failed after the Second stage of the test. For checking cracking to stage 'D', the middle one-third portion, which is folded with curvature outside, shall be examined according to the following method:

To ascertain, whether cracking has extended to the base fabric, bend the flexed test specimen face outwards,

around a glass rod 6 mm in diameter with a piece of a filter paper between the test specimen and the rod. Brush a suitable coloured fluid, such as red ink containing 2 percent of a wetting agent over the flexed surface. Consider the test specimen as cracked only if the ink stains the filter paper.

8 TESTS

8.1 Tests shall be conducted as prescribed in column 8 of Table 1 and other relevant Indian Standards, as referred in this standard.

8.2 Test Specimens

Test pieces shall be cut from the samples in the required number and in the appropriate manner as specified in the individual methods of test and in accordance with Annex K.

8.2.1 In case where less than 2 m sample is to be tested the number of test specimens may be reduced at the discretion of the purchaser.

9 PACKING, MARKING AND STORAGE**9.1 Packing**

The material shall be securely packed in the form of a roll so as to ensure safe transportation. Care should be taken so that the roll is not winded too tight, which may leave impression of back fabric on coated surface.

9.1.1 Roll Length

The material shall be in rolls of minimum 20 m length. Short lengths of less than 20 m shall be permitted, but the number of such short lengths shall not be more than 2 per roll. Further, no short length shall be less than 5 m in length. In any consignment, not more than 10 percent of the rolls shall contain 2 pieces.

9.2 Making

9.2.1 Each roll of coated fabric shall be supplied with a label with the following information:

- Name and/or trade-mark, if any, of the manufacturer;
- Type, grade and class of material;
- Month and year of manufacture;
- Length of coated fabric in the roll, in metres; and
- Any other statutory requirements.

9.2.2 BIS Standard Mark

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark

9.3 Storage

The rolls of expanded vinyl coated fabrics shall be stored vertically on dry, clean, firm and level surface. The rolls shall be protected from dust, moisture, direct sunlight, corrosive and solvent fumes.

10 SAMPLING, NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

10.1 Scale of Sampling

10.1.1 Lot

In any consignment, all the rolls of expanded vinyl coated fabrics of the same type, grade, colour and finish shall be grouped together and each such group shall constitute a lot.

10.1.2 The conformity of the lot to the requirements of the specification shall be ascertained for each lot separately. The number of rolls to be selected from lot shall depend on the size of the lot and shall be at random in accordance with Table 2.

10.1.3 The rolls shall be selected at random and to ensure randomness of selection, the procedure recommended in IS 4905 shall be followed.

Table 2 Scale of Sampling
(Clause 10.1.2)

| Sl No. | Lot Size | Number of Rolls to be Selected |
|--------|---------------|--------------------------------|
| (1) | (2) | (3) |
| i) | 1 | 1 |
| ii) | 2 to 100 | 2 |
| iii) | 101 to 200 | 3 |
| iv) | 201 to 300 | 4 |
| v) | 301 and above | 5 |

10.2 Number of Test

10.2.1 Each of the lengths obtained from a lot shall be examined for visual defects and coating and if found satisfactory, further tests as specified shall be carried out.

10.2.2 From each of the rolls selected according to **10.1.2**, 2 m length (measured between two weft threads) of expanded vinyl coated fabric shall be cut, care being taken to exclude not less than 0.25 m length of fabric from either end. The test specimens necessary for the various test specified in the standard shall be cut from the lengths of expanded vinyl coated fabric, thus obtained. Scheme of selection of test specimens from the sample length is given in Fig. 4. All the samples shall be kept out of contact from one another or any other material that may cause contamination.

10.3 Criteria for Conformity

10.3.1 The lot shall be declared as conforming to specification, if each of the test results satisfies the corresponding requirements as given in 7.

10.3.2 If the specimen, taken from a 2 m length, fails in one or more tests, each such tests shall be repeated twice. For this purpose two more samples shall be taken from the same batch/lot, but from the rolls, other than those , from which the earlier samples had been drawn. The specimens shall be cut from them, so that duplicate tests may be conducted in respect of each failure. If all the specimens pass the duplicate tests, the lot shall be declared conforming to the specification, otherwise not.

ANNEX A

(Clause 6.2)

DETERMINATION OF THICKNESS

A-1 APPARATUS

A-1.1 Gauge — The gauge shall be of dead-weight type, equipped with a dial graduated to read directly to 0.02 mm. The presser foot shall be circular having a diameter of 9.5 ± 0.02 mm or 50 ± 0.05 mm. The presser foot and connected moving parts shall be loaded to give the pressure according to the category of articles being measured. The presser foot and anvil surfaces shall be plane to within 0.002 mm, and parallel to one another to within 0.002 mm. The gauge shall be calibrated for the actual load exerted by the presser foot by means of any device so arranged as to measure the total force exerted by the presser foot at the several gauge readings or presser foot levels selected for calibration. The presser foot shall be brought to each calibration level from a higher one.

Pressure

- | | |
|-----------------------------------|---------------------------|
| a) Ordinary articles | 0.24 Kg/cm ² * |
| b) Articles sensitive to pressure | 0.10 Kg/cm ² * |

* 1 Kg/cm² = approx 98.07 kN/m².

A-2 PROCEDURE

A-2.1 Before each determination, clean the surfaces of the presser foot and anvil and adjust the dial gauge to register zero when the anvil and presser foot are in contact.

A-2.2 Measure the thickness on an oblique line drawn at an angle of 45° to the length of the roll, preferably at a distance of about 1 m from the end of the roll. On this line make five evenly distributed measurements, the first being taken at a position between 50 mm and 150 mm from the selvage.

A-2.3 Place the coated fabric on the anvil of the gauge, smoothen it but without tension. Lower the presser foot on to the material (without impact), allow it to rest for 10 s, observe and record the reading of the dial.

A-2.4 Expression of Results — Express the results in millimeters. The mean thickness shall be the arithmetic mean of the five measured values on the same oblique line.

ANNEX B

(Clause 7.4)

TEST FOR COLOUR, GRAIN AND FINISH (RECOMMENDED METHOD)

B-1 PROCEDURE

B-1.1 Colour comparison shall be made in good north daylight.

B-1.2 Normal colour vision is essential for reliable colour comparison.

B-1.3 It is imperative to note that the result is influenced by the gloss and the state of the surface of the coated fabric. In addition, the presence of embossing pattern and differences in gloss, induces variations, which can be large, in the results, while the colour itself remains the same. Moreover, reflection can vary noticeably from place to place on the surface depending on the embossing pattern.

B-1.4 Pattern shall be of adequate size and not less than 100 cm² when checking a standard or reference pattern against roll of material, it is useful to place the pattern on top of the material undergoing examination.

B-1.5 When comparing patterns of embossed materials, particularly two coloured, it is important to place them so that the grain 'runs the same way' in each test and also to view them from different angles. Slight difference of brightness or dullness of surface can effect colour comparisons and can be equalized by moistening the surface of both.

B-1.6 Standard patterns shall be kept clean and stored in the dark.

ANNEX C

(Clause 7.6)

TEST FOR RESISTANCE TO HEAT AND LOSS OF MASS ON HEATING**C-1 TEST SPECIMENS**

C-1.1 The same three specimens of 10 cm × 10 cm used to determine mass of finished fabric as per IS 7016 (Part 1/Sec 2) shall be subjected to this test.

C-2 APPARATUS

C-2.1 Circulating Air oven, of such a size that the total volume of the test assemblies does not exceed 10 percent of the free space in the oven.

C-2.2 The temperature of the oven shall be thermostatically controlled to maintain the temperature of the test assemblies within $\pm 2^\circ\text{C}$ of the specified temperature. Baffles shall be used, as required, to prevent overheating and dead spots. Provision shall be made for circulation of air through the oven at a rate such as, to provide a minimum of six air changes per hour.

C-3 PROCEDURE

C-3.1 Suspend the test specimens vertically, in a hot air circulating oven, after it has been preheated to the

specified operating temperature. The test pieces are to be stationary, free from strain and mounted so as to be at least 100 mm from the oven walls at any point, to permit adequate circulation of air on all sides of specimens.

C-3.2 At the end of the exposure period, take out the test specimens from oven and cool at room temperature for 60 min. Examine for any signs of exudation or stickiness. After this examination, condition the test specimens for 16 h at standard atmosphere and weigh the test specimens to the nearest 0.005 g.

C-4 CALCULATION

C-4.1 Calculate the loss in mass on heating as follows:

$$\text{Loss in mass, on heating, percent} = \frac{100(M_1 - M_2)}{M_1}$$

where

M_1 = mass in g, of the specimen taken for test; and

M_2 = mass in g, of the specimen after heating.

ANNEX D

(Clause 7.8)

TEST FOR COLOUR FASTNESS TO DRY AND WET RUBBING

D-1 APPARATUS

D-1.1 The apparatus shown in Fig. 1 shall consist of an abrading member *A* and a means of clamping the test piece over a plate glass surface *B* in such a manner that the abrading member and the test pieces are capable of relative reciprocating motion in a straight line. The amplitude of reciprocation, that is the stroke shall be 100 mm and the apparatus shall be mechanically operated or hand driven so that the rate of reciprocation shall be 15 ± 2 cycles (each of two strokes) per min.

D-1.2 Abrading Member

The abrading member *A* shown in Fig. 2, shall consist of a brass peg and shall be suitably and firmly secured to the arm of the apparatus so that its centre line is at right angles to the surface of the glass plate. The arms of the apparatus shall be not less than 230 mm in length measured from the centre point of the abrading member to the pivot, and shall be loaded in such a manner that the brass peg exerts a load of 5 N (0.5 kgf) on the test piece. Means shall be provided for firmly securing a strip of the specified bleached fabric around the end of the brass peg. Screw clip having been found suitable for this purpose. Suitable grips *C* and *D* shall be provided to ensure that the test piece can be secured firmly across the plate glass surface.

D-1.3 White Cotton Fabric

Bleached but not starched and in sufficient quantity for testing all the specimens. The bleached cotton fabric shall correspond to variety No. 1 of IS 177. Cut circles, 50 mm in diameter, from the bleached fabric for using in the tests.

D-2 TEST SPECIMENS

D-2.1 Cut from the sample at random not less than six rectangular pieces, 250 mm long and 50 mm wide, with

their length parallel to the warp direction. Condition the test specimens for not less than 2 h in the standard atmosphere and carry out the subsequent testing in that atmosphere.

D-3 PROCEDURE

D-3.1 Dry Rubbing

Cut a circle, 50 mm in diameter, from the bleached fabric (*see D-1.3*) and attach to the under surface of the abrading member of the apparatus, using the clip. Mount the test specimen with coated side uppermost over the plate glass surface such that the 'stroke' falls symmetrically within the dimensions of the test piece. Firmly secure the test piece in position by means of suitable grips, wipe with cotton-wool to remove dust and subject it to abrasion. Stop the test after 10 complete abrading cycles. Remove the fabric from the abrading member. Back each tested rubbing cloth with three layers of white rubbing cloth while examining the area of the fabric, which has been in contact with the specimen for colour stains. Assess the staining of the cotton rubbing cloths with the grey scale under suitable illumination.

D-3.2 Wet Rubbing

Carry out the test as given in **D-3.1** using a circle of bleached fabric dipped in soap-soda solution containing 5 g of soap (conforming to Type 1 of IS 285) and 2g of sodium carbonate (conforming to IS 296) in one liter of water, immediately prior to mounting on the abrading member. Subject the test piece to 10 complete abrading cycles. Remove the fabric and air dry. Back each tested rubbing cloth with three layers of white rubbing cloth while examining the area of the fabric, which has been in contact with the specimen for colour stains. Assess the staining of the cotton rubbing cloths with the grey scale under suitable illumination.

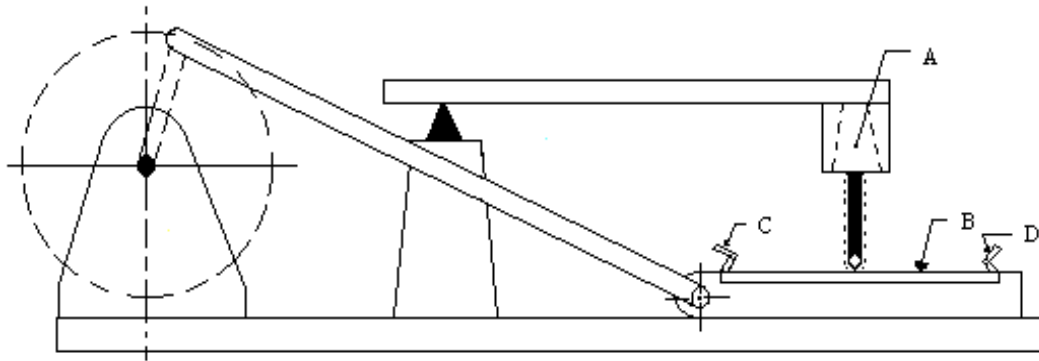
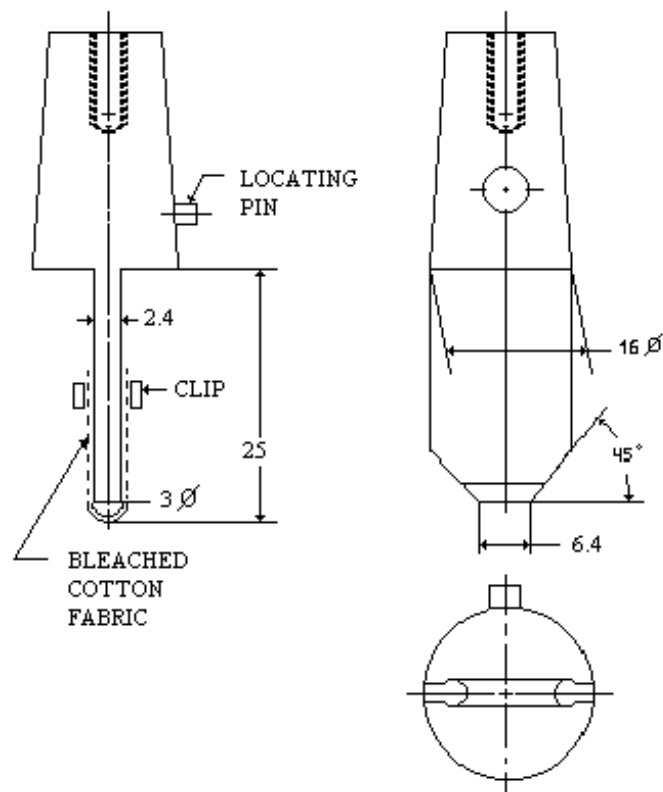


FIG 1. APPARATUS FOR MEASURING COLOUR FASTNESS TO DRY AND WET RUBBING AND ADHESION OF PRINT



All dimensions in millimeters.

FIG. 2 DETAILS OF ABRADING MEMBER A

ANNEX E

(Clause 7.9)

TEST FOR COLOUR FASTNESS TO LIGHT**E-1 APPARATUS**

The essential features of the apparatus are a wooden box of 90 cm × 60 cm × 5 cm with a cover of window glass of 3 mm thickness. The bottom of the box shall be fitted with wire mesh of 0.315 mm thickness to allow ventilation. A removable wooden rack with batten of wood, equally spaced, is fitted to the box. The approximate width of the batten shall be 10 cm and the distance between the battens shall be 5 cm. The batten shall be equally spaced to allow ventilation in the box.

E-2 TEST SPECIMENS

Cut from the sample at random a test specimen 130 mm long and 15 mm to 50 mm wide.

E-3 PROCEDURE

E-3.1 Place the box in the open, facing south in the northern hemisphere. Support on legs about 75 cm high, and incline the case horizontal at 45°. There shall be no obstruction from any direction. Place the test samples in the case so that no shadows are cast during day time on the exposed samples.

E-3.2 Attach to the rack a set of wool standards of convenient size along with the test specimens and put these in the exposure case. Protect half the portions

from light by covering the samples with aluminium foil or any suitable thin opaque material.

Wipe out daily the cover of the glass case to remove the dust falling on it. For mounting and testing for light fastness, follow any one of methods 3 or 4 prescribed in IS/ISO 105-B02.

E-4 REPORTING

E-4.1 Observe the test specimens and the wool standards at suitable intervals till the wool standard No. 4 shows a fading (the visual contrast between the exposed and the unexposed portions) equivalent to Grade 4 on the geometric grey scale. The glass lid shall be kept clean during the test.

E-4.2 Remove the specimens from the box, clean with soap solution (conforming to Type 1 of IS 285) and cold water. Dry and examine the test specimens indoors in good north light against a white background.

E-4.3 Compare the visual contrast between exposed and unexposed portions of the specimen with the Grade 4 on the geometric grey scale. If the contrast between the exposed and the unexposed portions of the specimen is equal to or less than the contrast of the grey scale, the material shall be declared conforming to the requirement, otherwise not.

ANNEX F

(Clause 7.11)

TEST FOR ADHESION OF PRINT

F-1 APPARATUS

F-1.1 Apparatus as given in **D-1.1**.

F-1.2 Abrading Member —Apparatus as given in **D-1.2**.

F-1.3 White Cotton Fabric — The bleached cotton fabric shall correspond to variety No. 1 of IS 177. Cut circles, 50 mm in diameter, from the bleached fabric for using in the tests.

F-2 REAGENT

F-2.1 Soap, conforming to Type 1 of IS 285.

F-3 PREPARATION OF TEST PIECE

Not less than three rectangular test pieces 250 mm × 50 mm shall be cut from the sample with their lengths parallel to the longitudinal direction of the sample. The test pieces shall be cut in such a manner that each contains a portion of the printed design in such a position that it will lie in the path of the abrading member. Where the printed pattern consists of a multi-coloured design, sufficient test piece shall be prepared to enable three tests to be carried out on each colour combination or print. By suitable choice

of position of test pieces, it is usually possible to have more than one print colour abraded during any particular test.

F-4 PROCEDURE

The test piece shall be washed with soap and water, rinsed and dried. They shall then be conditioned in the room in which the test is to be performed for at least 24 h before testing and the temperature throughout this period shall be maintained at $27 \pm 2^\circ\text{C}$. Each test piece shall be mounted in turn directly on the plate glass surface. No wrinkling of the test piece shall occur during test and it is permissible to stretch the test piece up to 20 percent in the direction of its length to avoid wrinkling. A 50 mm circle of the bleached fabric shall be then be secured to the glass peg. The ribbed side of the fabric shall be in contact with the peg. The peg to which the fabric has been fitted shall be lowered on to the test piece. The test piece shall then be subjected to 10 strokes of abrading member and observed for any visible damage.

F-5 EXPRESSION OF RESULT

Report the change in print pattern between the abraded and unabraded portions of the test specimen.

ANNEX G

(Clause 7.12.3)

TEST FOR FLAME RESISTANCE

G-1 APPARATUS

G-1.1 A Metal Stand — A stand shown in Fig. 3 shall have the size 300 mm × 300 mm, shielded from three sides up to 250 mm. The upper frame of the stand shall be used to fix the test specimen.

G-1.2 Bunsen Burner — Bunsen burner with 10 ± 1 mm internal diameter, with a supply of liquefied petroleum gas.

G-1.3 Paper Clamps — Large paper clamps shall be suitable to hold the specimen in slight tension.

NOTE — The paper clamps are similar to those used by students to clip paper on wooden board or plastic sheet.

G-1.4 Adjustable stand or wooden blocks to adjust the height of the burner.

G-1.5 Pinch cock for adjusting the height of the flame of the burner.

G-1.6 Stop watch of an accuracy 0.2 s.

G-2 TEST SPECIMEN

Cut from the sample a rectangular piece of size 300 mm × 400 mm which may sufficient to have enough length to be folded around the rods of the frame and clamped.

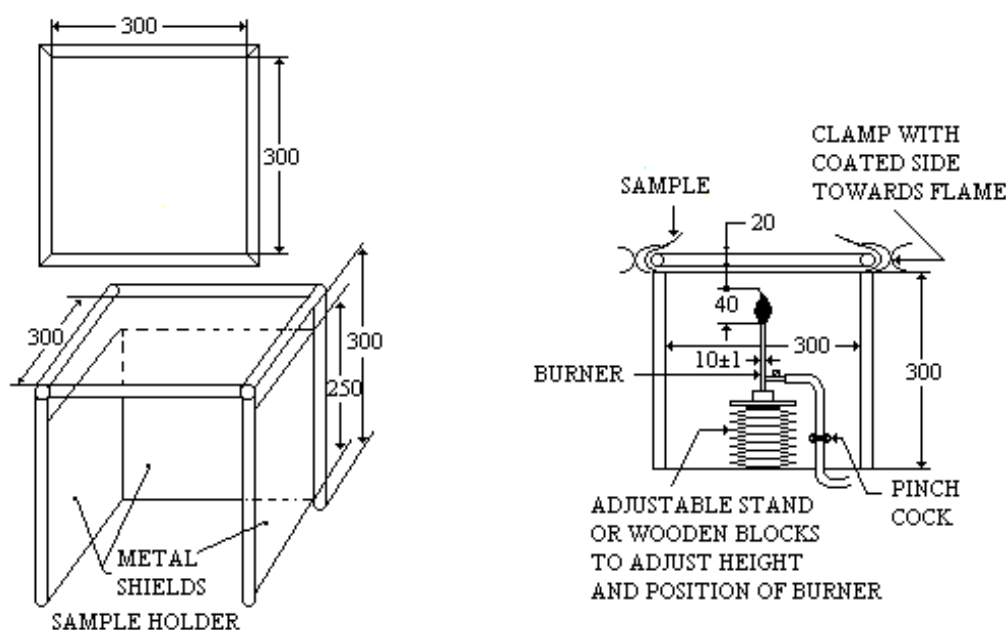
G-3 PROCEDURE

G-3.1 Set up the apparatus in a fume cupboard, support the test specimen horizontally, with the coated side of the fabric towards the flame, by means of four paper clamps, to each on the opposite sides of the specimen in such a manner that area of 300 mm × 300 mm will be exposed to flame without sag.

G-3.2 Shut off, completely, the air supply to the burner and adjust the burner to give a luminous flame of 40 mm in length by means of the pinch cock. Place the burner in such a position that the tip of the flame is 20 mm below the center of specimen. Apply the flame for a period of 20 s and then withdraw it.

G-3.3 Record separately by stop watch the time during which flaming continues.

G-3.4 The finished fabric when tested shall meet the requirement of 7.12.3.



All dimensions in millimeters

FIG. 3 APPARATUS FOR FLAME RESISTANCE TEST

ANNEX H

(Clause 7.15)

DETERMINATION OF RESISTANCE TO PENETRATION OF WATER**H-1 APPARATUS**

H-1.1 The apparatus shall consist of a central well fitted with a coaxial ring clamp to fasten the test piece over the well. The apparatus shall introduce water at test-room temperature from below the test piece over a circular area 100 cm² (approximately 113 mm diameter) in diameter at the rate of 10 ± 2 mm of hydrostatic head per second. The rubber tubing connecting the constant level device and the well shall have an inside diameter of not less than 6 mm.

H-1.2 If necessary, soft rubber sealing gaskets can be employed between the coated fabric test specimen and the surfaces of the clamps in order to block any leakage and reduce the risk of damage to the test specimen by the clamps.

H-2 TEST SPECIMENS

H-2.1 The test piece shall be either circular, of diameter 130 to 200 mm, or of corresponding square shape. It shall be taken at least 0.10 m from the selvage and 1 m from the end of the roll.

H-2.2 Unless otherwise specified in the material specification, three test pieces shall be tested from each sample unit.

H-3 PROCEDURE

H-3.1 Wipe all surface water from the clamping surfaces. Lay the test piece smoothly on the face of the lower ring of the clamp and fasten the upper plate in place, ensuring that the coated fabric is in contact with the water and that no air is trapped between the test piece and the water. This shall form a watertight compartment.

H-3.2 With the leveler at the zero position, turn the water on and keep it running at such a rate as to overflow continuously. Raise the constant level device at a rate of 10 mm/s to a predetermined height and record the time at which the first drop of water appears on the underside of the test piece. No account shall be taken of very fine droplets of water which are formed at or near the clamping edge.

H-3.3 The elapsed time before the first drop of water appeared on the underside, is noted for each test piece and the average value for all test pieces is determined.

ANNEX J

(Clause 7.16)

DETERMINATION OF ELONGATION AND ELASTIC RECOVERY FOR A CONSTANT LOAD**J-1 APPARATUS**

J-1.1 The essential features of the apparatus shall be two grips capable of clamping test specimens 100 mm wide. One grip (the upper grip) shall be capable of being attached to a fixed support so that when the test specimen is centered in the grip and clamped with the jaws of the grip running across the specimen, the specimen hangs in the vertical plane. The other (lower) grip shall be designed, so that dead loads can be added to bring its mass up to a total of 10 kg. The height of the frame shall be such that the loaded specimen can extend freely without touching the floor or lab bench.

J-1.2 A scale graduated in millimeters.

J-2 TEST SPECIMENS

Cut three specimens each 400 mm \times 100 mm with the length in the longitudinal direction, and three

specimens of the same size but with the length parallel to the cross-direction. Space the selection so as to cover fairly evenly the full width and available length of the sample, avoiding uncoated edges or selvage ends. Identify each specimen accordingly.

J-3 PROCEDURE

J-3.1 Draw two fine lines across each specimen, at right angles to its longest dimension, 100 mm from each end and 200 mm (L_1) apart. Draw a third line to cut these two lines at their midpoint. Make all measurements along this line.

J-3.2 Insert a specimen centrally in the upper grip, with the line at the upper end not less than 50 mm from the jaws. Insert the other end in the lower grip in the same way. Attach the fixed grip to the frame.

J-3.3 Apply smoothly to the lower grip a weight piece that will bring the total mass of the lower grip to 10 kg and note the time. After 10 min, measure and note the distance L_2 between the two lines, with specimen still under tension.

J-3.4 Remove the load and withdraw the specimen from the grips. Place it on a flat horizontal surface. After 10 min measure and note the distance L_3 between the two lines.

J-3.5 Repeat the procedure with the remaining specimens.

J-4 EXPRESSION OF RESULTS

J-4.1 Calculate the elongation, expressed as a percentage of the initial distance between the lines, from the formula:

$$\text{Elongation, percent} = \frac{(L_2 - L_1) \times 100}{L_1}$$

where

L_1 = the original distance, in mm, between the lines;
and

L_2 = the distance, in mm, between the lines, after extension under constant load.

J-4.2 Calculate the elastic recovery, expressed as a percentage of elongation, from the formula:

$$\text{Elastic recovery, percent} = \frac{(L_2 - L_3) \times 100}{(L_2 - L_1)}$$

where

L_3 = the distance, in mm, between the lines after recovery.

J-4.3 Calculate the elongation and elastic recovery for each specimen and report the means for the set of three specimens in each direction to the nearest 0.5 percent.

J-4.4 If the conditions of test vary from the standard above (*Example* — In relation to specimen length), the conditions shall be reported.

ANNEX K

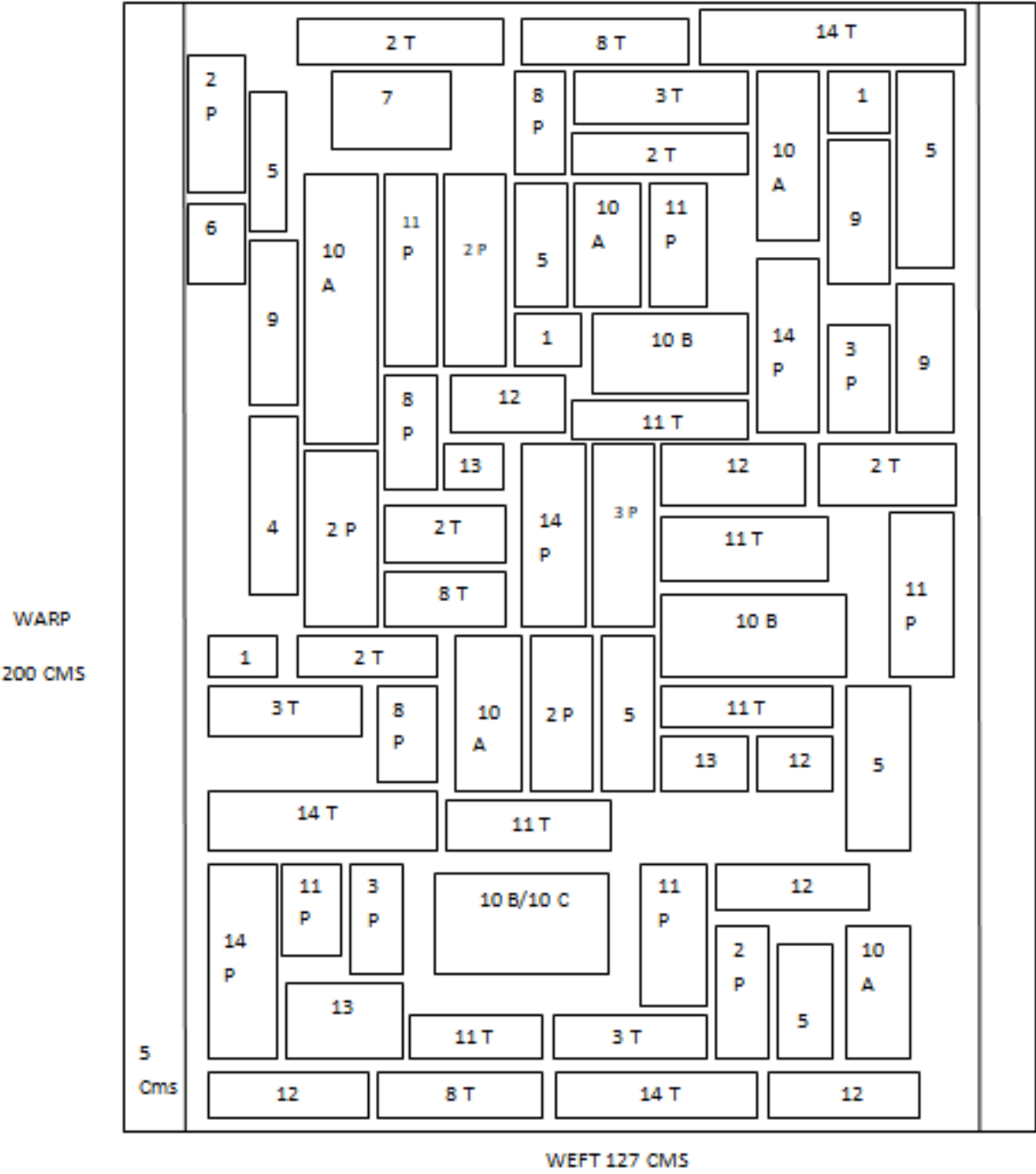
(Clause 8.2)

METHOD OF SELECTION OF TEST SPECIMENS

K-1 METHOD

K-1.1 The test specimens shall be selected from 2 m sample of full width, when it is laid on a flat rigid surface with fabric side uppermost without any tension in either direction.

K-1.2 Draw the lines for test specimens over the sample as laid in K-1.1, in accordance with Fig. 4 which shows the positions of the specified numbers of specimens for each test.



P = specimen in the warp direction, and
T = specimen in the weft direction

FIG. 4 SCHEME FOR SELECTION OF TEST SPECIMENS (NOT TO SCALE)

SCHEME OF SELECTION OF TEST SPECIMENS FOR TESTING

| Sl No. | Characteristic | Test Method | Clause | No. of Specimen | Size of Specimen |
|--------|--|---------------------------------------|---------|----------------------|---|
| 1 | Mass of coated fabric | IS 7016 (Part 1/Sec 2) | 7.18 | 3 | 100 mm × 100 mm |
| | Resistance to heat and loss of mass on heating | Annex C | 7.6 | | |
| 2 | Breaking/tensile strength | Method 1 of IS 7016 (Part 2) | 7.18 | Warp = 5 Weft = 5 | 300 mm × 50 mm 300 mm × 50 mm |
| 3 | Tear strength | Method A of IS 7016 (Part 3/Sec 1) | 7.18 | Warp = 3 Weft = 3 | 225 mm × 75 mm 225 mm × 75 mm |
| 4 | Resistance to cold | | 7.7 | 1 | 250 mm × 6 mm |
| 5 | Colour fastness to dry and wet rubbing | Annex D | 7.8 | 6 | 250 mm × 50 mm with length parallel to warp |
| 6 | Colour fastness to light | Annex E | 7.9 | 1 | 130 mm × 50 mm |
| 7 | Gelling test | | 7.10 | 1 | 250 mm × 50 mm |
| 8 | Resistance to damage by flexing | Method A of IS 7016 (Part 4) | 7.18 | Warp = 3 Weft = 3 | 125 mm × 37.5 mm 125 mm × 37.5 mm |
| 9 | Adhesion of print (for printed products) | Annex F | 7.11 | 3 | 250 mm × 50 mm with length parallel to warp |
| 10A | Flame resistance (Class A) | 3.2 of IS 15061 | 7.12.1 | 5 | 356 mm × 100 mm |
| 10B | Flame resistance (Class B) | 3.3 of IS 15061 | 7.12..2 | 3 | 560 mm × 170 mm |
| 10C | Flame resistance (Class C) | Annex G | 7.12.3 | 1 | 300 mm × 400 mm |
| 11 | Adhesion of coating | IS 7016 (Part 5) | 7.13 | Warp = 5 Weft = 5 | 200 mm × 75 mm 200 mm × 75 mm |
| 12 | Blocking resistance | IS 7016 (Part 9) | 7.14 | 6 | 150 mm × 150 mm |
| 13 | Resistance to penetration of water | Annex H | 7.15 | 3 | Circular of dia 130 mm |
| 14 | Elongation and elastic recovery | Annex J | 7.16 | Warp = 3 Weft = 3 | 400 mm × 100 mm 400 mm × 100 mm |

ANNEX M

(Foreword)

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